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Effects of Radar Absorbing Material (RAM) on the Radiated Power of Monopoles with Finite Ground Plane

by Christos E. Maragoudakis and Vernon Kopsa

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White Sands Missile Range, NM 88002-5513

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14. ABSTRACT
The effects of Radar Absorbing Material (RAM) on the radiation pattern of a monopole over finite ground plane are presented. The transmitted power of the monopole antenna was measured while varying the separation distances between the ground plane and the RAM. The findings of the measurements are presented in graphical form.

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1. Introduction

During testing performed in anechoic chambers, antennas are placed near the chamber walls which are covered with radar absorbing material (RAM). Furthermore, the antennas could be placed near or on RAM structures. Normally “rules of thumb” are used to determine the minimum distance at which the radiators must be placed from the walls. Unfortunately, these rules do not provide any information on the effects on the radiated power when the radiators are placed at a distance shorter than the optimum distance. In this technical note the results of an investigation that was performed to determine the effects of RAM on power radiated by a monopole antenna over finite ground plane placed on a RAM block are presented.

2. Test Set-up and Procedure

The monopole with the finite ground plane for which radiation was to be measured was placed at a distance $\lambda/2$ above the block of RAM at the center of the chamber. A 20-decibel (dB) standard gain horn antenna mounted on mast at the end of the chamber was used as a receiver. The receiving antenna was rotated to maximize the received power. When the separation distance was $\lambda/2$, the received power was used as a reference for the experiment. The separation distance between the ground plane and the RAM was then reduced and the received power was recorded and normalized. The test set-up used for the investigation is shown in figure 1.

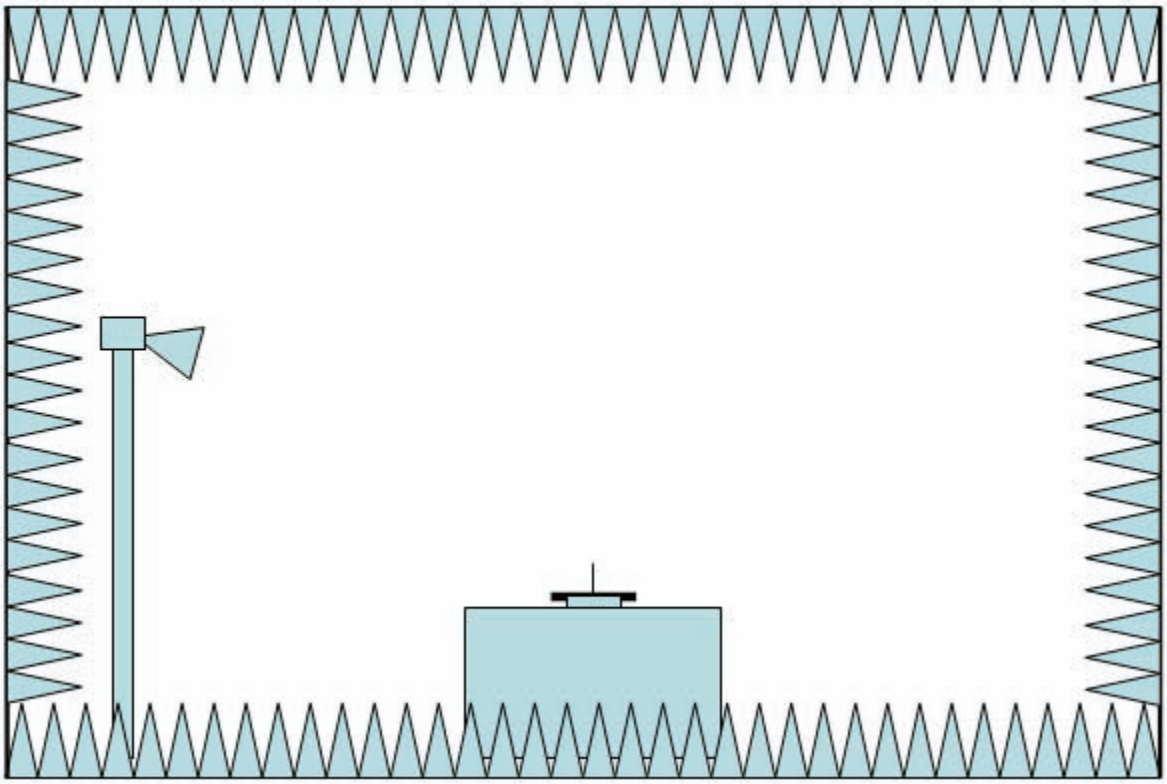

Figure 1. Test set-up.

3. Results

The effects of the RAM on the radiated power were determined by measuring the radiated power and varying the distance between the ground plane and the RAM. The power levels were then normalized to power received when the separation distance between the ground plane and the RAM was $\lambda/2$. The attenuation as a function of the separation distance between the ground plane and the RAM is shown in figure 2.

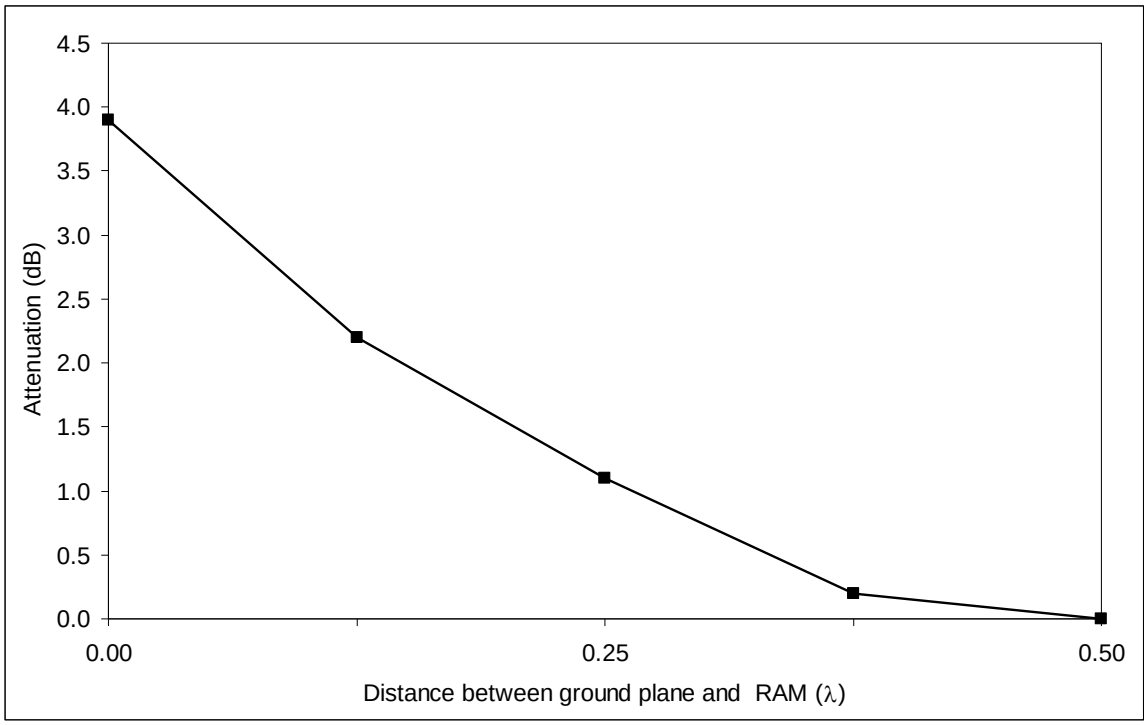

Figure 2. Effects of RAM on radiated power.

As seen from the graph, the radiated power is mostly affected when the ground plane is placed on the RAM. When the distance between the ground plane and the RAM is about λ/16, the attenuation is about –3 dB and it decreases as the distance between the RAM and the ground plane increases. When the distance between the RAM and the ground plane is λ/2, the effects of the RAM are negligible.

4. Conclusions

The distance between the ground plane and the RAM greatly affects the radiated power from a monopole over finite ground when it is placed on RAM. To minimize the effects of the RAM the ground plane must be placed at least λ/2 above the RAM.

5. Recommendations

It is recommended that the effects of RAM on the radiated power of other antennas be determined when the antennas are placed at distances less than λ/2 from the RAM.

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